

BIOLOGICAL CONTROL STRATEGY FOR GREENHOUSE CUCUMBER PRODUCTION



GLOBAL HORTICULTURAL INC. CONTROL AGENTS FOR GREENHOUSE CUCUMBERS

PEST	BCA	PRODUCT	RATE		TIMING	COMMENTS
			m ²	ft ²		
Thrips, Western Flower Thrips, Chili Thrips and other species <i>(Frankliniella occidentalis, Scirtothrips dorsalis)</i> Note: <i>Amblyseius cucumeris</i> will also help in controlling spider mites. <i>A. cucumeris</i> can be used year round. If both thrips and whitefly are present or if temperatures are consistently above 24°C / 75°F, replace <i>Amblyseius cucumeris</i> with <i>Amblyseius swirskii</i> .	<i>Amblyseius cucumeris</i> or <i>Amblyseius swirskii</i>	<i>Cucumeris / Swirskii</i> stick sachets	1 sachet per plant		Use stick sachets at transplanting at propagator.	Communicate with propagator.
		<i>Cucumeris / Swirskii</i> hook sachets	1 sachet per 3-6 plants		Release either every 2 weeks (1 per 6 plants) or every 4 weeks (1 per 3 plants).	Sachets typically release mites between 4-6 weeks, but it's recommended to re-introduce every 4 weeks. Hang sachets between the crop. Avoid hanging them in direct sunlight or close to heating pipes. Hang the sachet on the plant 18-25 cm (6-8 inches) from the top.
	<i>Amblyseius cucumeris</i>	<i>Cucumeris</i> loose	150-200	15-20	Release every week. Curative --> 400 / m ² every week	Distribute evenly over leaf canopy.
	<i>Orius insidiosus</i>	<i>Orius</i> adults	0.5-1	0.05-0.1	Release 4 consecutive weekly introductions. For optimal establishment and carry over in consecutive crops, ornamental pepper banker plants (Purple flash) are recommended.	NOTE: <i>Orius</i> egg laying capacity can be boosted by introducing <i>Ephestia</i> eggs weekly during the first 4 to 6 weeks of establishment at the rate of 4 grams per acre.
Two-spotted spider mites <i>(Tetranychus urticae)</i> Note: <i>Amblyseius andersoni</i> , <i>Amblyseius californicus</i> and <i>P. persimilis</i> can be used year round.	<i>Amblyseius andersoni</i> or <i>Amblyseius californicus</i>	<i>Andersoni / Californicus</i> sachets	1 sachet per 3-6 plants early in the crop.		Best results are achieved with sachets, but can also be released as loose application. Repeat introduction with heavy infestations.	Hang sachets between the crop. Avoid hanging them in direct sunlight or close to heating pipes.
		<i>Andersoni / Californicus</i> loose	4-6	0.4-0.6		
	<i>Phytoseiulus persimilis</i>	<i>Phytoseiulus</i> loose	8-10	0.8-1	Start when first spider mites are detected. Repeat weekly until <i>P. persimilis</i> is established and spider mites are controlled. Curative --> 100-150 / m ² in and around hotspots.	Twist the bottle slowly during use for a more even distribution of the mites. Sprinkle material on the larger leaves and avoid introduction in bright sunlight. Early detection improves results.

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Whitefly Greenhouse whitefly <i>(Trialeurodes vaporarum)</i> Silverleaf whitefly <i>(Bemisia tabaci)</i> Note: If <i>Amblyseius swirskii</i> is released for whitefly it will also help in controlling thrips. <i>A. swirskii</i> requires temperatures >20°C (68°F) for optimal performance.	<i>Amblyseius swirskii</i>	<i>Swirskii</i> sachets	1 sachet per 3-6 plants		If plants are touching use 1 sachet per 3-6 plants, otherwise 1 sachet per plant. Start at first sign of whitefly. Release every 4 weeks.	Sachets typically release mites between 4-6 weeks, but it's recommended to re-introduce every 4 weeks. Hang sachets between the crop. Avoid hanging them in direct sunlight or close to heating pipes. Hang the sachet on the plant 18-25 cm (6-8 inches) from the top.	
		<i>Swirskii</i> loose	100-150	10-15	Release every 1-2 weeks. Curative --> 300-400 / m ² .	Distribute evenly over leaf canopy.	
		<i>Encarsia formosa</i> & <i>Eretmocerus eremicus</i>	<i>Encarsia</i> / <i>Eretmocerus</i> mix	3-5	0.3-0.5	Start at first signs of whitefly. Release weekly until whitefly is controlled. Curative --> min. 10 / m ² every week until whitefly is controlled.	Optimal introduction method for <i>Eretmocerus</i> wasps is blister packs. Keep blister packs (or cards) out of direct sunlight and open release flap on the back.
		<i>Delphastus catalinae</i>	<i>Delphastus</i> adults	In hotspots		Release in hotspots of whitefly.	<i>Delphastus</i> requires high numbers of whitefly.
		<i>Dicyphus hesperus</i>	<i>Dicyphus</i> adults	3-4 <i>Dicyphus</i> per mullein plant each week for 8 weeks		20-40 mullein plants per acre. Start introducing <i>Dicyphus</i> as soon as possible after planting. Feed 4 gram <i>Ephestia</i> eggs per week during establishment.	Generalist predator - will feed on eggs, larvae and pupae of whitefly, along with thrips, moth eggs and various species of mites. Must use mullein banker plants to establish and maintain population.
Aphids - smaller species: Green peach aphid, Cotton melon aphid (<i>Aphis gossypii</i>, <i>Myzus persicae</i>)	<i>Aphidius colemani</i>	<i>Colemani</i> adults / mummies	0.25-1	0.025-0.1	Release weekly. Curative --> 1 / m ² weekly until control.	Use in combination with banker plants.	
	<i>Rhopalosiphum padi</i>	Aphid banker plants	Minimum 1 / acre (2.5 / ha)		Initial introduction is 2 banker plants per acre followed by 1 per acre every 2 weeks. Consistence releases and maintaining the banker plants are key to success.		
	<i>Aphidoletes aphidimyza</i>	<i>Aphidoletes</i> pupae	1	0.1	Release at first signs of aphids. Release weekly until control of aphids has been achieved.	Be aware of diapause between Mid-October and beginning of March.	
	<i>Chrysoperla spp.</i>	<i>Chrysoperla</i> larvae	10-20	1-2	Release in hotspots of aphids. Works as a quick knock down.		
	<i>Hippodamia convergens</i>	<i>Hippodamia</i> adults	10-20	1-2	Release in hotspots of aphids. Works as a quick knock down.		
Caterpillars / loopers <i>(Trichoplusia ni</i> and other species)	<i>Podisus maculiventris</i>	<i>Podisus</i> nymphs	0.05	0.005	Release weekly a few containers starting early in the crop until establishment.	If hotspots with loopers occur, focus releases on hotspots. The nymphs develop better in the presence of prey.	

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	<i>Orius insidiosus</i>	<i>Orius</i> adults	As thrips strategy		An established <i>Orius</i> population can be a significant contributor to looper control as they prey on moth eggs. Avoid interference from systemic crop protection products that harm <i>Orius</i> by focussing on aphid control using BCAs.	
	<i>Bacillus thuringiensis</i>	N/A	Follow label instructions		Little to no negative effect on other BCAs.	
Fungus gnats & shore flies (<i>Bradysia spp.</i> & <i>Scatella spp.</i>)	<i>Stratiolaelaps scimitus</i> (<i>Hypoaspis miles</i>)	<i>Stratiolaelaps</i> loose	100	10	Apply at sticking / seeding and at transplanting.	If applied at rooting stage, a 2 nd application should be half rate at transplanting.
	<i>Dalotia coriaria</i> (<i>Atheta coriaria</i>)	<i>Dalotia</i> adults / larvae	2	0.2	Apply at sticking / seeding and at transplanting.	If applied at rooting stage, a 2 nd application should be half rate at transplanting.
	<i>Steinernema feltiae</i> & <i>Steinernema carpocapsae</i>	<i>Steinernema feltiae</i> / <i>carpocapsae</i> sponge	20,000	2,000	Apply at sticking and repeat twice during rooting stage. Re-apply after transplanting.	Correct application is critical for efficacy. Make sure solution is agitated, fine filters are removed and pressure is kept low.

NOTE: Unfortunately at this time there are no bio-control solutions available for *Lygus spp.* and cucumber beetles. However, there are clear indications from field experiences that the presence of generalist predators such as *Orius insidiosus* and *Dicyphus hesperus* established in a cucumber crop seems to have an effect on the presence of *Lygus* and cucumber beetles. It's therefore recommended to use all three banker plant systems in cucumber crop settings to reduce risk to have to interfere with the traditional pesticide products.

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